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ABSTRACT

Technical considerations in the development of a salary equity model based upon regression analysis are reviewed, and a simplified salary prediction equation is examined. Application and communication of the results of the analysis within the existing operational context of a postsecondary institution are also addressed. The literature is reviewed, with an example of the application of the model provided. The model to predict salaries incorporates in the prediction equation rank, highest degress, administrative status, discipline, years-in-rank, endowed chair, and contract status. The total university prediction equation does not include discriminatory variables such as sex, race, age, or years-employed. A separate equation, incorporating these biased variables, which tests for the possible presence of salary inequities, is discussed. All instructional faculty on a contractual basis, numbering between 500 and 1,000, are included in the regression equation. Results from a multiple regression equation model guide the identification of individual faculty members who appear to be making high or low salaries for their status, discipline, and experience. A high level of predictability was shown in the model, and this result was in conformance to the actual salary structure. It is suggested that fundamental political skills are essential in balancing the forces that affect salaries, but a salary equity study can provide comprehensive information that decision-makers value when they manage conflict. A bibliography is appended. (SW)

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MANAGING SALARY EQUITY

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Abstract

Even the most conscientious and diligent administrator seldom has adequate time in the budget review cycle to review individually the salaries of a faculty approaching 1,000. Results from a multiple regression equation model guide the identification of individual faculty members who appear to be making high or low salaries for their status, discipline, and experience. A high level of predictability was shown in the model posited--deemed important in that it conformed to the actual salary structure. Fundamental political skills are essential in balancing the forces which impact upon salaries, but a salary equity study can provide comprehensive information that decision makers value when they manage conflict.

Managing Salary Equity

Managing salary equity is more than an affirmative action program. It touches upon the health and well-being of an institution as a whole. Given that institutional viability is contingent upon faculty, the reward structure is closely associated with ability to retain valued faculty, hire new faculty, and preserve a sense of collective purpose.

Much can be learned when the activities and characteristics of a university faculty are related to its reward structure. The degree to which faculty characteristics predict salaries gives insight into the dynamics of an institution. It is interesting to understand how any institution works, and whether and to what extent inequities exist in its instructional salaries.

This paper addresses two specific questions: What are important conceptual and technical considerations in the development of a faculty salary equity model based upon regression analysis? How can the results of such an analysis be applied and communicated effectively within the existing operational context of a postsecondary institution? First, a body of related literature is reviewed. An applied example is then presented, based upon a successful experience since 1972.

Review of Model Specification

The most critical aspect of research employing multiple regression techniques is the explicit development and specification of the model. Specifying the model entails making assumptions about the organization of the data and the relationships among the variables. Ramsay (1979) has argued that to "simply use a prepackaged model is dangerously naive. The

numerical results of regression analysis are crucially determined by the underlying model" (p. 52). A model is no better than the care and concern displayed in its preparation. The model builder must be concerned with how and why each variable is important (Braskamp, Langston & Muffo, 1978). Failure to do this is sure to invite the problems that result from use of ad hoc models.[1] Variables often employed in models of faculty salaries are rank, academic discipline, and academic experience indicators.

Rank

Previous research on faculty salaries generally agrees that rank is the strongest predictor of salary (Astin & Bayer, 1972; Katz, 1973; and Loeb & Ferber, 1971). Faculty rank is both an objective variable and, importantly, a proxy variable. A proxy variable is a surrogate for a factor or factors which have not been or cannot be readily measured.

Given the seminal nature of rank in determining salary, it is necessary to assume that rank is a function of non-discriminatory factors. Thus, rank can be seen as a measure of many implicit and explicit characteristics of a given faculty member. Typically, academic rank is strongly related to three key indicators of academic performance--teaching ability, scholarship, and service, all difficult to measure. This also infers that, given rank, the relationship of various imprecise measures of these three performance characteristics may not show up as being strongly predictive of salary. This is not a problem in prediction; rather, it is a consequence that should be noted (Prather & Smith, 1974; Reagan & Maynard, 1974).

Academic Discipline

Academic discipline also is an important determinant of salary. The impact of discipline upon faculty rewards is complex and confounding; it

is a variable heavy with ambiguity and obliqueness. Its weight is influenced by: 1) supply and demand in the academic labor market for that discipline; 2) institutional factors, including fluctuations in student enrollment in the discipline with consequent expansion and contraction of the curriculum; and 3) department factors which influence salary, including paradigm development.[2]

Supply and Demand. A state commission on human rights formally ruled that paying differentials by field of competence is not considered an inequity but is a common industry-wide practice (Hunter, 1979). Brittingham, Pezzullo, Ramsay, Long, and Ageloff (1979) noted that any offer of positions in the history department brought hundreds of resumes, while filling a position in the accounting department required active recruiting. These market factors are nationwide and can be considered intrinsic to the system. Academic submarkets for each discipline are such that there is almost no movement between fields (Tuckman & Tuckman, 1976). Salary surveys show that salary differentials among fields appear consistently in similar institutions.

Institutional Factors. The impact of discipline is intertwined with that of institutional factors upon salaries (Schwab & Dyer, 1979). Student enrollment declines can bring about pressure for curriculum changes in departments which find they are in a disadvantageous institutional position (Manns & March, 1978). Conversely, expansion of the departmental curriculum affects the promotional opportunities in the department (Keyfitz, 1973).

Departmental Factors. Moore and Pfeffer (1980) stated that "the departmental affiliation of a faculty member is one of the most salient

institutional labels" (p. 294). A discipline with a high market factor will often be one that is a powerful department in the institution. The power of a department has a significant effect on rewards to its faculty (Kalleberg & Sorenson, 1979; Bibb & Form, 1977). While each faculty member must learn to prepare his professional case for the maximum likelihood of a favorable response, a strong department is a vital source of assistance due to its contacts, seniority level, prestige, and/or size.

A model of power in budget decisions has been suggested (Pfeffer & Moore, 1980), and is shown in Figure 1. This model implies that in a university, powerful departments also would be those receiving greater amounts of contracts and grants; greater external linkages and contacts of such a department would be reflected in higher budgets.

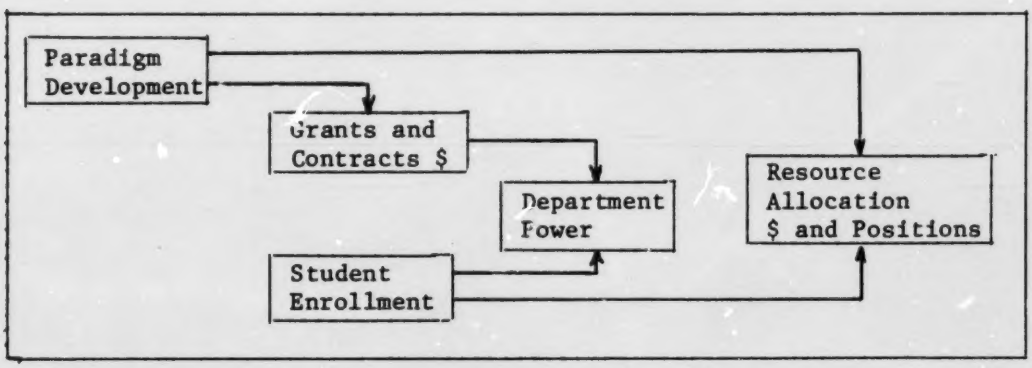


Figure 1. Model: Power in Budget Decisions (from Pfeffer & Moore, 1980)

Departmental power is defined as the ability to achieve desired outcomes and courses of action in circumstances where that department's preferences conflict with those of other departments. It is vitally important both from a conceptual and an empirical basis to include a measure of academic department which reflects this concept of power because

budgeting is more likely to follow a political rather than a rational model.

Academic Experience

Certain background characteristics of faculty members influence salary outcomes in a complex interaction with academic discipline and department. One of these characteristics is academic experience, the next most important consideration in model specification. Faculty seniority denotes experience and a knowledge of the folkways of campus politics and power. Seniority can be a proxy for scholarship productivity in a manner similar to the way rank and academic department are proxies. Experience, however, is not only linearly associated with salary, but also incorporates a nonlinear component (Johnson & Stafford, 1973; Tolles & Melichar, 1968). The impact of scholarship productivity tends to overshadow that of teaching or service. Some additional important variables are those of compensation for administrative service, such as head of the department, special categories within ranks, and endowed chairs.

Prediction Model of Salaries

The model posited here to predict salaries includes what are normally considered unbiased predictors of salary. Specifically, the example model incorporates rank, highest degree, administrative status, discipline, years-in-rank, endowed chair and contract status. These variables form the prediction equation of faculty salaries. The total university prediction equation does not include discriminatory variables such as sex, race, age, or years-employed. A separate equation, incorporating these biased variables, is discussed which tests for the possible presence of salary

inequities. All instructional faculty on a contractual basis, numbering between 500 and 1000, are included in the regression equation.

The variables measuring rank, highest degree and discipline are expressed in dichotomous form. The model specification requires that variables measuring seniority, such as years-in-rank, be included in the number of years-in rank and also years-in-rank squared. The squaring of the variable reflects a nonlinear specification that as years-in-rank grow greater, the salary benefits for years-in-rank will decrease (Johnson & Stafford, 1974; Tolles & Melichar, 1968). The measure of contract status is full-time equivalent, which is measured as one minus FTE (1 - FTE). This measure expedites the interpretation of this variable where the increasing FTE level reflected a lower "correction factor" for being less than 12 months full-time.

How well the hypothesized model conforms to the data is measured by the multiple correlation squared (R^2). Because of the large number of variables included, the R^2 is shown adjusted for the number of variables included. Also in each equation is a standard error of estimate (SEE). The SEE is the standard deviation of the residuals, or the average difference between actual salaries and predicted salaries. For instance, the prediction equation has an adjusted R^2 of .90. Previous studies have shown R^2 ranges from .22 to .95 (Pezzullo & Brittingham, 1979; McLaughlin, Smart, & Montgomery, 1978). An R^2 of .90 can be interpreted to mean that 90% of the variance in the salaries of the teaching faculty can be accounted for by the prediction model.

To determine the dynamics of faculty salaries, separate equations were calculated by college, rank, and sex. The model employed to test for bias, which includes academic status, discipline, seniority, race, and sex, has an adjusted R^2 of .90. A major finding of the test for bias is that no overall pattern of inequity for female or minority faculty was evident. Reflecting the national faculty labor market, different disciplines have differing market values. This is true for the equation to test for bias and for the separate equations by college, rank, and sex. Contrary to national findings, the market factors by discipline are the strongest for assistant professors.

Communicating the Results

Salary equity studies have three major conceptual components: 1) specification of the proper model; 2) fitting the data to the model; and 3) comparison of the predictions of the model with actual data--a key phase. Technical considerations are vital to insure integrity in this type of policy analysis. However, busy administrators generally seek answers to pragmatic and political questions and are not attuned to long, detailed technical reports. Rejection of research findings will likely result if the report itself focuses upon technical questions that are not considered relevant by issue-driven decision makers. While academic research is often structured in concern for the past, administrators are often future-oriented. Further, if regression analyses are intended to assist in salary management they must be communicated in a form that can be accepted and used by the intended audience. A successful salary equity report is possible if the research is undertaken with an awareness

of and active concern for the intended audience. Concrete examples follow of how communication has been facilitated by salary equity reports since 1972.

A Simplified Prediction Equation

Table 1 shows the prediction equation for university teaching faculty salaries. This format for presenting the prediction equation includes the dollar weights associated with each variable. To derive a predicted salary entails inserting the corresponding dollar weights associated with that individual's respective characteristics and then summing the values. This simplified presentation of the formula helps the reader see how the predicted salary was derived.

Applications of Residual Analysis

The difference between actual and predicted salary is the residual. Little is reported in the literature about how residual analyses can be applied to depict the difference between actual and predicted salary. Figure 2 is a graphic illustration, based upon an analysis of residuals, showing visually the distribution of salary residuals by male and female teaching faculty for the institution. It can be quickly observed from this "box-and-whiskers"[3] plot that no average difference exists between sexes. However, male faculty do have both higher positive and negative residuals, which indicates that more males than females have actual salaries higher or lower than predicted. The range then for females is narrower than for males, which suggests that affirmative action efforts have been made.

Table 1

Prediction Equation for

University Teaching Faculty Salaries

$1000 > N > 500$

Rank			=	$_____
University Professor		$18,600		
Professor		11,500		
Associate Professor		5,200		
Assistant Professor		1,300		
Instructor		0		
Degree				
Doctorate		1,700	=	$_____
Masters		600		
Bachelors and Other		0		
Years-in-Rank	_____	X 600	=	$_____
Years-in-Rank Squared	_____	X -20	=	$_____
*Department Market Factor			=	$_____
Department Head		6,500	=	$_____
Endowed Chair		26,500	=	$_____
Full-time Equivalent (FTE)		-32,500 X (1-FTE)	=	$_____
Base (or Constant)				$ 21,500
PREDICTED SALARY				$_____
Standard Error of Estimate				± 3,100

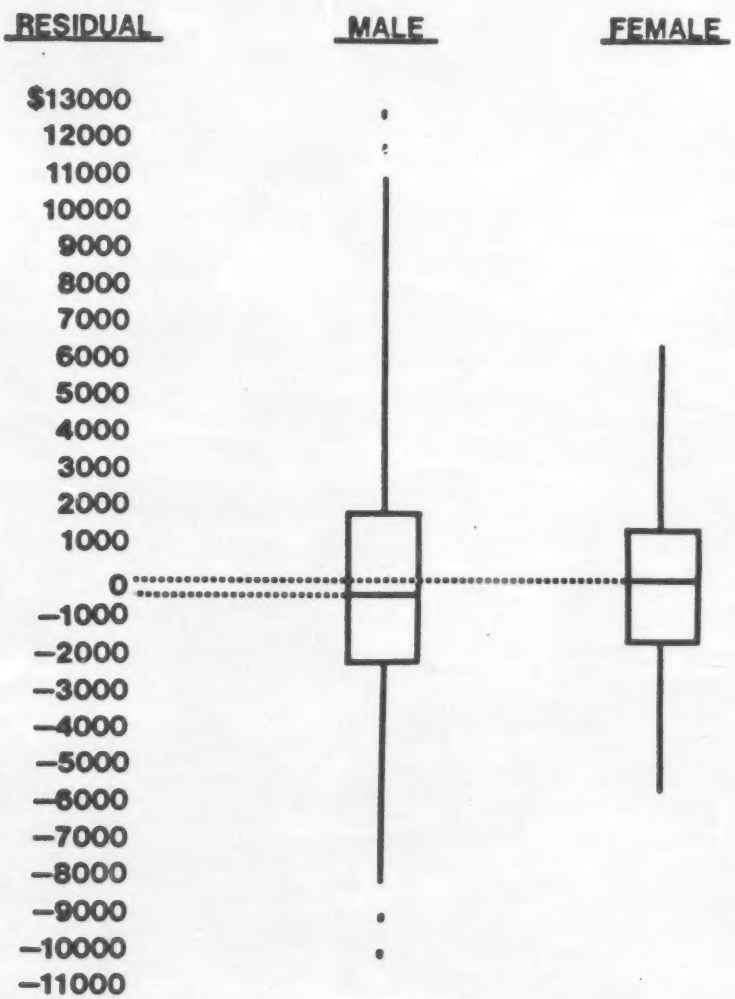
Adjusted R^2 = .90

*(Ranges from -4,800 to +9,000)

Figure 2

Distribution of Teaching Faculty Salary Residuals by Sex

1000 > N > 500



	MALE	FEMALE
Median	−$105	$142
Mean	$62	−$176
S.D.	$3130	$2426
%N	74%	26%

Summary tabular formats also can be designed to convey important salary information. Such a format is illustrated in Table 2, which is a summary of anomalous cases by college, department and sex; it shows faculty who have predicted salaries which are either one or more standard errors of estimate (SEE) higher or lower than their actual salaries. These tallies, provided on one page, show comparisons on the departmental, college or university levels. This method of summary representation allows for a concise salary equity study overview. The example shows that for the university as a whole, 16% of the high residuals are female, 25% of the low residuals are female, and 26% of the total university faculty are female. Given the insignificance of the sex variable in the total university equation compared to the disproportionate number of women with low residuals, it appears that there may be an indication of what is called "unpatterned inequities" for some individual female faculty members which are not exhibited for the female faculty as a group. The disproportionate number of men having an actual salary substantially higher than predicted may be due to the presence of unpatterned individual inequities.

Not even the most conscientious and diligent administrator has adequate time to review the salaries of a faculty approaching 1000 in size. Individual-level salary information guides the identification of exceptional cases. Results from a multiple regression equation model can focus upon those individual faculty who appear to be making unusually high or low salaries for their status, discipline, and experience. It is just as important for the higher-than-predicted cases to be identified as for the lower-than-predicted cases.

Table 2

Summary of Anomalous Cases by College, Department, and Sex

$1000 > N > 500$

Department/ College	Number of High Residuals		Number of Low Residuals		Number of Other Faculty	
	Male	Female	Male	Female	Male	Female
College A						
Department 1	1		1		5	1
Department 2		2		2		2
Department 3			1		1	4
Department 4			1		1	4
Department 5		2		1	2	5
Department 6				2		30
Department 7	1			1		2
Total College A (%)	(33)	(67)	(33)	(67)	(16)	(84)
College B						
Department 8					3	3
Department 9	2		1	2	18	3
Department 10	3	1	2	2	5	2
Department 11	3		2	1	9	
Department 12	4		4		14	7
Department 13	1	1	2	1	10	4
Department 14	2		2		2	
Department 15	1		1		3	
Department 16	2	1	2		13	3
Department 17		1	1		6	1
Department 18	3		1	3	12	3
Department 19	1	1	2		16	4
Department 20					8	1
Department 21	2		3		7	
Department 22	3		2		9	1
Department 23	5		3	2	15	5
Department 24	3	1	2		8	2
Department 25		1			2	1
Total College B (%)	(83)	(17)	(73)	(27)	(80)	(20)
College C						
Department 26	2		3		22	1
Department 27	3		7	1	18	1
Department 28	2		4		9	
Department 29	1		1		13	1
Department 30	3		4	2	6	
Department 31	4		4		21	
Department 32					13	2
Department 33	1		4	1	17	3
Department 34			1		9	1
Department 35			1		9	
Total College C (%)	(100)		(88)	(12)	(94)	(6)
College D						
Department 36	1		2		3	8
Department 37	4		2		7	3
Department 38			2		18	12
Department 39					10	1
Department 40					6	3
Department 41	1			1	14	3
Department 42	1	1	1		4	11
Department 43	1				18	2
Total College D (%)	(89)	(11)	(88)	(12)	(65)	(35)
TOTAL UNIVERSITY (%)	(84)	(16)	(75)	(25)	(73)	(27)

A convenient form has been developed which has served over a period of time to bring to the attention of decision makers only those faculty members whose salaries appear to be anomalies compared to those of the institution as a whole. Figure 3 provides a hypothetical example of department sheets made available to academic administrators on anomalous salary cases. For many of these cases justifications are provided in the annual budget review process. Individual performance differences in teaching, scholarship, or service account for many of them. Additionally, salaries of individual faculty members may represent special cases which include such factors as a reward for early retirement, funds paid through a sponsored grant, or professional dormancy.

In this example, only 24% of the total faculty are shown as having high or low salaries. Such an approach facilitates a budget review process by focusing on exceptions. Also, administrators are made more conscious that every promotion, retirement, raise, or new hiree will affect the relative standing of other faculty members.

Discussion

Instructional salaries in higher education are a sensitive and volatile issue. There seems to be commonality among institutions on faculty perceptions of the reward structure. Interviews have been held at the University of Rhode Island with faculty members having unusually high or low predicted salaries compared to their actual salaries. Long (1979) found that many faculty attribute apparent salary inequities to such factors as new hirees, merit, departmental leadership, cronyism, and department philosophy, especially relative to teaching versus research

Figure 3

Hypothetical Example of Departmental Sheets Made
Available to Administrators on Salary Anomalous Cases

DEPARTMENT: "X"

NAME	RANK	FTE	ACTUAL SALARY	PREDICTED SALARY	DIFFERENCE
Extreme Residual Higher than Predicted:					
MALES:					
Dr. J. R. Dallas	PROF	.75	52,534	41,412	11,122
Mr. W. T. Houston	ASOP	.75	37,768	33,435	4,333
FEMALES:					
Extreme Residual Lower than Predicted:					
MALES:					
Dr. N. Y. Troy	PROF	1.00	36,260	42,128	- 5,868
Dr. Sid Albany	PROF	.75	33,114	37,925	- 4,811
Dr. Roy St. Paul	ASOP	.75	26,093	32,132	- 6,039
Mr. A. L. Montgomery	ASOP	.50	19,539	26,124	- 6,585
FEMALES:					
Dr. Virginia Richmond	PROF	.75	31,864	39,984	- 8,120
Ms. Mimi Paris	INST	.33	7,736	11,353	- 3,617

TOTAL DEPARTMENT

	TOTAL	OVER	%	UNDER	%	OTHER	%
MALES	15	2	(13)	4	(27)	9	(60)
FEMALES	2	____		2	(100)	____	
TOTAL	17	2	(12)	6	(35)	9	(53)

emphases. Surprisingly, he found that women sensed less inequity in salaries than did men. Some of the reasons he was given for salary differentials were: no Ph.D., powerful chairman fought hard for faculty raises, the squeaking wheel gets the grease, personality was more important than merit, salary catch-up increases had been promised but not given, a strong tendency to hire new faculty at higher salaries, and salaries tended to be increased by a steady incremental rate.

Brittingham et al. (1979, pp. 114-117) recommended that salary studies be given wide distribution within an institution. These authors also view a salary equity report as an integral part of a comprehensive program of faculty personnel administration. Some of their other recommendations suggested a permanent salary review board to consider cases on the basis of discriminatory hiring practices and changing market conditions; more control over entry faculty salaries; and specific stipends for administrative duties. Brittingham et al. made their recommendations in hopes of reducing "perceived" inequities.

This paper reviewed many technical considerations in the development of a salary equity model based upon regression analysis. Extending this approach, the paper presented and discussed a simplified salary prediction equation, and ways to communicate the existence of salary anomalies. Regression salary analysis has been the subject of previous research, but its application within an institution is less frequently discussed.

Construction of a model using purely mechanical methods to predict faculty salaries was presented. The R^2 of .90 reported indicates a high level of salary predictability. It is important to offer the caveat that

striving to increase an R^2 to the magic 1.00, indicating "perfect" prediction, may not be a desirable goal for researchers to pursue. The fit of the equation is important to insure that it conforms to reality--not that it defines or sets reality. Any equation that sets salary would necessarily be indicative of the decision makers' abdication of the all-important function of allowing for such unique needs as balancing a department, insuring the long-term viability of a program, or rewarding qualitative improvements. To freeze such "soft" data into a model leads to an inflexible, unresponsive salary schedule. There has been at least one legal case (the University of Nebraska vs. Dawes, 1975) in which a ruling was given that if a strict formula approach is made to salaries, then this must be applied to all faculty members. The experience of rigid salary schedules in government bureaucracies should be warning enough that a multiple regression model should not be a substitute schedule for the decision maker.

"Managing salary equity" is more than an affirmative action program. It touches upon the health and well-being of the institution as a whole. During the 1960's and early 1970's when increasing funds were readily available each year, the issue of the presence of possible inequities tended to become a minor one for the institution. In an era when tight budgets continue to lose to inflation, or severe retrenchment is necessary, the salary equity question takes on new importance. Given that the viability of an institution is contingent upon its faculty, salary distribution is closely associated with an ability to retain valued faculty, hire new

faculty, and preserve a sense of collective purpose. Powerful disciplines and departments easily distort salary patterns. Perceived inequities can be more troubling than actual ones. Fundamental political skills aid in balancing the forces which impact upon salaries, but a salary equity study can provide comprehensive information that decision makers value when they manage conflict.

Footnotes

[1] The problems of ad hoc modeling include collinearity (see Belsley, et al., 1980); proxy variables; specification bias or omitted variables; and simultaneous equation bias.

[2] The paradigm development of an academic discipline influences its budget allocation. Paradigm development is defined as the level of agreement within an academic discipline of 1) research methodology; 2) course content; and 3) research issues and problems. The degree to which a department has consensus over theories and methods would be an indication of its level of paradigm development; the greater the level of paradigm, the more centralized power is within a department. Those disciplines with highly developed scientific paradigms have an advantageous position in faculty rank promotion questions because the judgment of faculty quality is more objectively and easily made, and the individual faculty member has clearer guidelines of what research to do and what and how to teach. This is reflected in clearer and more certain evaluation criteria (Pfeffer & Moore, 1980).

[3] See Tukey (1977, Chapter 7) for applications of "box-and-whisker" plots. The box includes the second and the third quartiles of the distribution and the division within the box is the median.

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